PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2002-100562
(43)Date of publication of application : 05.04.2002

(51)Int.Cl. H01L 21/027
H05B 3/00

(21)Application number : 2001-130326
(22)Date of filing : 24.03.2001

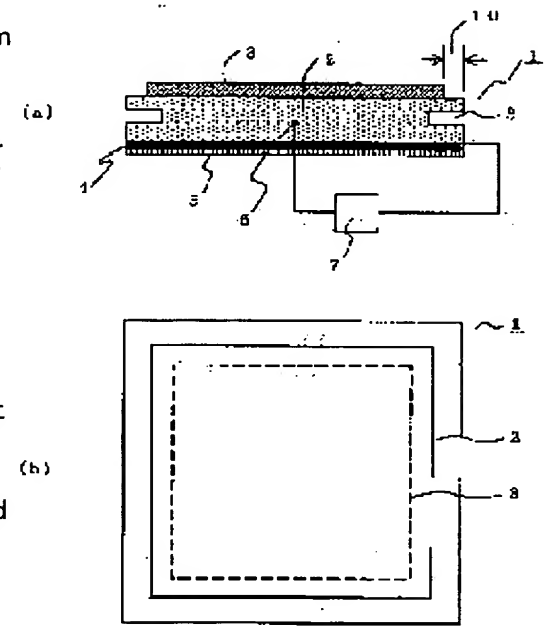
(71)Applicant : SIGMA MELTEC LTD
(72)Inventor : TAKANO MICHIROU
KATADA OSAMU

(30)Priority

Priority number : 2000137857 Priority date : 03.04.2000 Priority country : JP
2000254655 21.07.2000 JP

(54) HEAT TREATMENT SYSTEM OF SUBSTRATE

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a heat treatment system of substrate in which a resist pattern having a good in-plane uniformity can be formed by making uniform the transient and settling temperatures of a substrate when it is heated or cooled.
SOLUTION: Thermal capacity per unit area is lower at the outer circumferential part of a substrate as compared with that in the central part. The heat treatment system comprises a lower heat plate provided with a temperature control means, a spacer having a low thermal conductivity disposed along the outer circumference of the lower heat plate, and a side heat plate provided with at least one temperature control means.
Alternatively, the heat treatment system comprises a lower heat plate provided with a temperature control means, a spacer having a low thermal conductivity disposed along the outer circumference of the lower heat plate, a side heat plate provided with at least one temperature control means, and an upper heat plate provided with a temperature control means.



LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates substrates, such as a semiconductor, a liquid crystal panel, and its photo mask, to heating or the thermal treatment equipment to cool.
[0002]
[Description of the Prior Art] It explains taking the case of the photo mask for semiconductors. The spatter of about 0.1-micrometer chromium film is carried out on a glass substrate with a thickness of 6.3mm by 152mm square, and after it applies a resist on it and draws a pattern with an electron ray, the photo mask for the newest semiconductors is resist-developed, continuously, it performs etching and resist exfoliation of a chromium film, and is completed.
[0003] The chemistry amplification mold resist from which a resist pattern with it is obtained is developed with improvement in the degree of integration of LSI, and detailed-izing of a pattern, and utilization is progressing. [high and dry etching-proof nature and] [highly precise] Typical goods are SAL601 of SHIPURE.
[0004] Since it performs baking after drawing at about 110 degrees C and performs sensitivity amplification of a resist after carrying out electron beam lithography of the chemistry amplification mold resist, the resist pattern size after development changes with dispersion in the temperature at the time of baking a lot. Therefore, in order to form a circuit pattern with a sufficient precision, a thermal treatment equipment with a uniform temperature within a mask side is required.
[0005] As equipment which bakes a substrate to homogeneity, JP,7-5447,A, JP,7-211628,A, and JP,7-281453,A are proposed.
[0006] JP,7-5447,A is indicating the equipment which encloses a fluid with the space between a heater hot platen and lower housing, and heats a substrate including the hot platen and lower housing which connote a heater and this heater.
[0007] JP,7-211628,A is indicating substrate heating apparatus including a heating means, the hot platen with which the concentric circle-like hollow was formed, a temperature detection means, and a temperature control means.
[0008] JP,7-281453,A lays a heated substrate in the hot platen equipped with the heater, makes the inferior surface of tongue of the up hot platen equipped with the heater approach the periphery of a heated substrate, and is indicating the substrate heating method heated from the lower part of a heated substrate, and the upper part.
[0009] All of these proposals make homogeneity temperature within the substrate side in the time of elevated-temperature stability, for example, a 110-degree C condition.
[0010] Not only the temperature homogeneity at the time of elevated-temperature stability but the temperature homogeneity in the transient at the time of heating and cooling is known by influencing the precision of a pattern size greatly with improvement in a degree of integration.
[0011] Since the amount of flashes of a hot platen is as large as 10-20mm, when the conventional thermal treatment equipment lays and heats a thick substrate to the conventional thermal treatment equipment like the photo mask for semiconductors to the magnitude of a substrate, since heat is supplied also from the portion of the hot platen protruded from the substrate, the substrate periphery section has the defect in which the temperature of the periphery section rises early transitionally.
[0012] When cooling the heated substrate, a transient has the defect in which the temperature of the periphery section descends early, like the time of heating.
[0013] Drawing 7 (a) is the temperature profile of the thermal treatment equipment equipped with a

conventional up hot platen and a conventional lower hot platen. A reference number 20 measures a total of nine temperature of a 152mmx152mm square mask at intervals of 65mm, and shows aging of the mean temperature.
[0014] In the reference number 21, the transient characteristic at the time of mask heating and a reference number 22 show the property at the time of elevated-temperature stability, and the reference number 23 shows the transient characteristic at the time of cooling.
[0015] The reference number 24 of drawing 7 (b) shows aging of the maximum temperature gradient of nine points within a mask side. Since the temperature of a periphery rose early at the time of heating, the maximum temperature gradient was 5.5 degrees C.
[0016] Although it became small at about 0.5 degrees C at the time of elevated-temperature stability, since the temperature of a periphery descended early at the time of cooling, the maximum temperature gradient was 8.3 degrees C.
[0017] Thus, when the temperature gradient in the transient at the time of heating and cooling is large, the problem of ****** for a bad influence is in the precision of a pattern size.
[0018]
[Problem(s) to be Solved by the Invention] The purpose of this invention is offering the thermal treatment equipment which makes homogeneity heating of a substrate, or the transient of cooling and the temperature at the time of stability, and forms the good resist pattern of the homogeneity within a field.
[0019]
[Means for Solving the Problem] It is characterized by heat capacity per unit area of the substrate periphery section being smaller than heat capacity per unit area of a center section.
[0020] Moreover, it is characterized by consisting of a gap object with low lower hot platen and thermal conductivity equipped with a temperature control means, and a flank hot platen equipped with a temperature control means.
[0021] Moreover, it is characterized by thermal conductivity arranged along with a periphery of a lower hot platen equipped with a temperature control means and said lower hot platen consisting of a low gap object, a flank hot platen equipped with at least one temperature control means, and an up hot platen equipped with a temperature control means.
[0022]
[Example] Hereafter, this invention is explained with reference to a drawing. In addition, the same reference number is given to the same component, and explanation is omitted. Drawing 1 (a) is the drawing of longitudinal section of the 1st example of this invention, and drawing 1 (b) is the plan.
[0023] A heater 4 is pinched by the lower hot platen 2 and the bottom plate 5, and the lower hot platen 2 is heated. A temperature sensor 6 is arranged in the center section of the lower hot platen 2, and it heats to constant temperature, for example, 110 degrees C, with a thermoregulator 7. Although temperature may be set up with a thermoregulator 7, you may set up with a temperature setting means (not shown) by which the exterior became independent.
[0024] In order to give the structural additional coverage of a conveyance means to lay a mask 3, as for the lower hot platen 2, enlarging is more desirable than a mask 3 10-20mm. In this example, it may be 15mm.
[0025] Therefore, only a part with a large area of the lower hot platen 2 can raise the homogeneity of the heating transient of the mask 3 although the heat capacity of the lower hot-platen periphery section became large, when it makes the heat capacity of a periphery equivalent to a center section by at least one slot 8 along with the periphery of the lower hot platen 2 and lays a mask 3 in the lower hot platen 2.
[0026] In the conventional thermal treatment equipment, although the maximum temperature gradient within the field of the mask 3 of a heating transient was 5.5 degrees C, in the lower hot platen 2 of this invention possessing the with a width-of-face depth [20mm depth of 5mm] slot 8, it was 3.2 degrees C.

[0027] Moreover, it set to the transient which is also completely the same as when cooling the heated mask 3, and cools a mask 3, and although the maximum temperature gradient within the field of a mask 3 was 8.3 degrees C in conventional equipment, it was 4.8 degrees C in the lower hot platen of this invention possessing a slot 8.
[0028] Drawing 2 is the drawing of longitudinal section of the 2nd example of this invention.
[0029] It is the example which the thickness of the periphery 15 of the lower hot platen 12 was gradually decreased instead of forming a slot in a hot platen, and made the heat capacity of a periphery small.

[0030] Drawing 3 is the drawing of longitudinal section of the 3rd example of this invention.
[0031] It is the example which the thickness of the periphery 16 of the lower hot platen 13 was decreased continuously, and made the heat capacity of a periphery small.
[0032] Thus, by making thickness of the periphery of a hot platen thin, heating of a substrate or the temperature gradient in the 3rd page of the mask in the transient and stable state of cooling can be made small, and a resist pattern with a high precision can be formed.
[0033] Drawing 4 (a) is the drawing of longitudinal section of the 4th example of this invention, and drawing 4 (b) is the plan.
[0034] Like a semiconductor mask, in the case of a thick substrate, in a stable state, heat may be radiated from the substrate side, and the temperature of the substrate periphery section may fall from the temperature of a center section. In order to prevent this temperature fall, it is higher than the thickness of a mask 3, or the homogeneity at the time of elevated-temperature stability improves especially by arranging the side plate 14 of equal height.
[0035] When a side plate 14 is a thermally conductive high metal, heat is supplied to a substrate periphery, the temperature homogeneity of a transient worsens, but since thermolysis from a substrate periphery can be lessened while the quantity of heat supplied to a substrate periphery can be lessened in the case of thermally conductive low resin, temperature homogeneity at a transient and the time of stability can be improved. Since the lower hot platen 2 becomes an elevated temperature, a side plate 14 has small heat capacity, and it is desirable to use heat-resistant high polyimide resin or fluororesin.
[0036] Moreover, as well as the 1st example when using a metal for a side plate 14, and only the part of the heat capacity which increased with the side plate 14 enlarges a slot 8, temperature homogeneity of a transient can be realized.
[0037] Drawing 5 (a) is the profile of the 5th example of this invention, and drawing 5 (b) is the plan.
[0038] In order that the 1st - the 4th example might amend the thermal imbalance by a lower hot platen becoming larger than a substrate, they made small the heat capacity per unit area of the substrate periphery section, and were making substrate temperature take down to homogeneity a rise or the bottom.
[0039] On the other hand, the example of **** 5 makes a lower hot platen the almost same magnitude as a substrate, arranges a lower hot platen and the flank hot platen isolated thermally, and makes homogeneity take down substrate temperature to the surroundings of it a rise or the bottom.
[0040] As shown in drawing 5 (a), this thermal treatment equipment isolates the side of the lower hot platen 30 thermally with the gap object 34 with large thermal resistance, and arranges a flank hot platen. The side of a mask 3 is heated with a heater 32 and the flank hot platen 31 pinched by the bottom plate 33. By arranging the gap object 34, additional coverage can be given also structural.
[0041] The lower hot platens 30 are a temperature sensor 6, a thermoregulator 36, and the temperature setting means 35, for example, are heated at 110 degrees C. The flank hot platens 31 are a temperature sensor 37, a thermoregulator 38, and the temperature setting means 39, for example, are heated at 112 degrees C.
[0042] It prevents that heat radiates heat from the side of a mask 3 with the flank hot platen 31, and the temperature homogeneity of a mask 3 is raised.
[0043] It is suitable to set up the temperature of the flank hot platen 31 more highly 2-5 degrees C than the temperature of the lower hot platen 30.
[0044] As for the gap object 34, it is desirable for thermal resistance to use heat-resistant high polyimide resin and fluororesin greatly.
[0045] In that case, when a mask 3 is laid in the lower hot platen 30, since the heat transfer from the flank hot platen 31 to the lower hot platen 30 decreases, a mask 3 can be crossed to the whole surface and can carry out a temperature rise to homogeneity.
[0046] Although ****** [the number of the heaters 32 of the flank hot platen 31 / sides / of lower hot platens / four / one], by arranging a heater and a thermoregulator about each side, respectively, they can set the flank hot platen of each side as optimum temperature, and can raise soak nature further.
[0047] Drawing 6 is the drawing of longitudinal section of the 6th example of this invention.
[0048] This example adds an up hot platen to the 1st - the 5th example, and raises especially the temperature homogeneity of a stable state.
[0049] As shown in drawing 6 , this thermal treatment equipment is heated from all with the up hot platen 41 which pinched the mask 3 by the lower hot platen 30, the flank hot platen 31, and a heater 42 and a bottom plate 43.

[0050] The up hot platen 41 is set up with a temperature sensor 40, a thermoregulator 46, and the temperature setting means 45, and is controlled to constant temperature.
[0051] Moreover, by making the inferior surface of tongue of an up hot platen into the shape of a dome which has a concave surface as shown in the reference number 44 of drawing 6 , four corners of a mask 3 can be heated strongly and the temperature homogeneity at the time of a stable state can be raised.
[0052] In the example of **** 6, 2.5 degrees C and the maximum temperature gradient within a field at the time of elevated-temperature stability of the maximum temperature gradient within a field of the mask 3 of the heating transient when setting [the temperature of the lower hot platen 30] the temperature of 113 degrees C and the up hot platen 41 as 112 degrees C for the temperature of 110 degrees C and the flank hot platen 31 were 0.2 degrees C.
[0053] In the conventional thermal treatment equipment, since the heating transient was [the time of 5.5 degrees C and elevated-temperature stability] 0.5 degrees C, the engine performance improved sharply.
[0054] Although the above-mentioned explanation described the case where a thermal treatment equipment heated a substrate, if the heater of heating apparatus is made into an isothermal cooling water jacket or the condensator using the Bell Choi element, this invention is completely applicable about the case where a substrate is cooled, similarly.
[0055] Moreover, although explained taking the case of the mask for semiconductors, this invention is completely applicable to a semiconductor wafer, a liquid crystal panel, etc. which must heat-treat a substrate to high degree of accuracy in the above-mentioned explanation, similarly.
[0056]
[Effect of the Invention] As explained above, this invention does the following effects so. The temperature gradient within heating of a substrate or the substrate side at the transient of cooling and the time of stability is made small, a homogeneous good resist pattern is obtained, and it becomes possible to realize high accumulation and the detailed pattern of LSI.

[Translation done.]

CLAIMS

[Claim(s)]
[Claim 1] A thermal treatment equipment characterized by heat capacity per unit area of the substrate periphery section being smaller than heat capacity per unit area of a center section in equipment which heat-treats a substrate.
[Claim 2] Said thermal treatment equipment according to claim 1 characterized by forming a slot in the side along with a periphery of said lower hot platen.
[Claim 3] Said thermal treatment equipment according to claim 1 characterized by having a portion into which thickness decreases gradually or so continuously that it goes to a periphery of said lower hot platen.
[Claim 4] Said thermal treatment equipment according to claim 1 characterized by having been higher than substrate thickness on a periphery of said lower hot platen, or providing a side plate of equal height on it.
[Claim 5] Said thermal treatment equipment according to claim 4 characterized by the quality of the material of said side plate being resin.
[Claim 6] A thermal treatment equipment characterized by thermal conductivity arranged in equipment which heat-treats a substrate along with a periphery of a lower hot platen equipped with a temperature control means and said lower hot platen consisting of a low gap object and a flank hot platen equipped with at least one temperature control means.
[Claim 7] It is characterized by said gap object being polyimide resin or fluororesin, and is said thermal treatment equipment according to claim 6.
[Claim 8] Said thermal treatment equipment according to claim 6 characterized by the amount of flashes of said lower hot platen being larger than a substrate 0.5-3mm.
[Claim 9] Said thermal treatment equipment according to claim 6 characterized by equipping said flank hot platen with one temperature control means per side.
[Claim 10] A thermal treatment equipment characterized by thermal conductivity arranged in equipment which heat-treats a substrate along with a periphery of a lower hot platen equipped with a temperature control means and said lower hot platen consisting of a low gap object, a flank hot platen equipped with at least one temperature control means, and an up hot platen equipped with a temperature control means.
[Claim 11] It is characterized by said gap object being polyimide resin or fluororesin, and is said thermal treatment equipment according to claim 10.
[Claim 12] Said thermal treatment equipment according to claim 10 characterized by the amount of flashes of said lower hot platen being larger than a substrate 0.5-3mm.
[Claim 13] Said thermal treatment equipment according to claim 10 characterized by equipping said flank hot platen with one temperature control means per side.
[Claim 14] Said thermal treatment equipment according to claim 10 characterized by an inferior surface of tongue of an up hot platen having a concave surface.

[Translation done.]

TECHNICAL FIELD

[Industrial Application] This invention relates substrates, such as a semiconductor, a liquid crystal panel, and its photo mask, to heating or the thermal treatment equipment to cool.

[Translation done.]

PRIOR ART

[Description of the Prior Art] It explains taking the case of the photo mask for semiconductors. The spatter of about 0.1-micrometer chromium film is carried out on a glass substrate with a thickness of 6.3mm by 152mm square, and after it applies a resist on it and draws a pattern with an electron ray, the photo mask for the newest semiconductors is resist-developed, continuously, it performs etching and resist exfoliation of a chromium film, and is completed.
[0003] The chemistry amplification mold resist from which a resist pattern with it is obtained is developed with improvement in the degree of integration of LSI, and detailed-izing of a pattern, and utilization is progressing. [high and dry etching-proof nature and] [highly precise] Typical goods are SAL601 of SHIPURE.
[0004] Since it performs baking after drawing at about 110 degrees C and performs sensitivity amplification of a resist after carrying out electron beam lithography of the chemistry amplification mold resist, the resist pattern size after development changes with dispersion in the temperature at the time of baking a lot. Therefore, in order to form a circuit pattern with a sufficient precision, a thermal treatment equipment with a uniform temperature within a mask side is required.
[0005] As equipment which bakes a substrate to homogeneity, JP,7-5447,A, JP,7-211628,A, and JP,7-281453,A are proposed.
[0006] JP,7-5447,A is indicating the equipment which encloses a fluid with the space between a heater hot platen and lower housing, and heats a substrate including the hot platen and lower housing which connote a heater and this heater.
[0007] JP,7-211628,A is indicating substrate heating apparatus including a heating means, the hot platen with which the concentric circle-like hollow was formed, a temperature detection means, and a temperature control means.
[0008] JP,7-281453,A lays a heated substrate in the hot platen equipped with the heater, makes the inferior surface of tongue of the up hot platen equipped with the heater approach the periphery of a heated substrate, and is indicating the substrate heating method heated from the lower part of a heated substrate, and the upper part.
[0009] All of these proposals make homogeneity temperature within the substrate side in the time of elevated-temperature stability, for example, a 110-degree C condition.
[0010] Not only the temperature homogeneity at the time of elevated-temperature stability but the temperature homogeneity in the transient at the time of heating and cooling is known by influencing the precision of a pattern size greatly with improvement in a degree of integration.
[0011] Since the amount of flashes of a hot platen is as large as 10-20mm, when the conventional thermal treatment equipment lays and heats a thick substrate to the conventional thermal treatment equipment like the photo mask for semiconductors to the magnitude of a substrate, since heat is supplied also from the portion of the hot platen protruded from the substrate, the substrate periphery section has the defect in which the temperature of the periphery section rises early transitionally.
[0012] When cooling the heated substrate, a transient has the defect in which the temperature of the periphery section descends early, like the time of heating.
[0013] Drawing 7 (a) is the temperature profile of the thermal treatment equipment equipped with a conventional up hot platen and a conventional lower hot platen. A reference number 20 measures a total of nine temperature of a 152mmx152mm square mask at intervals of 65mm, and shows aging of the mean temperature.
[0014] In the reference number 21, the transient characteristic at the time of mask heating and a reference number 22 show the property at the time of elevated-temperature stability, and the reference number 23 shows the transient characteristic at the time of cooling.
[0015] The reference number 24 of drawing 7 (b) shows aging of the maximum temperature gradient of nine points within a mask side. Since the temperature of a periphery rose early at the time of heating, the maximum temperature gradient was 5.5 degrees C.
[0016] Although it became small at about 0.5 degrees C at the time of elevated-temperature stability, since the temperature of a periphery descended early at the time of cooling, the maximum temperature gradient was 8.3 degrees C.
[0017] Thus, when the temperature gradient in the transient at the time of heating and cooling is large, the problem of ****** for a bad influence is in the precision of a pattern size.

[Translation done.]

EFFECT OF THE INVENTION

[Effect of the Invention] As explained above, this invention does the following effects so. The temperature gradient within heating of a substrate or the substrate side at the transient of cooling and the time of stability is made small, a homogeneous good resist pattern is obtained, and it becomes possible to realize high accumulation and the detailed pattern of LSI.

[Translation done.]

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] The purpose of this invention is offering the thermal treatment equipment which makes homogeneity heating of a substrate, or the transient of cooling and the temperature at the time of stability, and forms the good resist pattern of the homogeneity within a field.

[Translation done.]

MEANS

[Means for Solving the Problem] It is characterized by heat capacity per unit area of the substrate periphery section being smaller than heat capacity per unit area of a center section.
[0020] Moreover, it is characterized by consisting of a gap object with low lower hot platen and thermal conductivity equipped with a temperature control means, and a flank hot platen equipped with a temperature control means.
[0021] Moreover, it is characterized by thermal conductivity arranged along with a periphery of a lower hot platen equipped with a temperature control means and said lower hot platen consisting of a low gap object, a flank hot platen equipped with at least one temperature control means, and an up hot platen equipped with a temperature control means.

[Translation done.]

EXAMPLE

[Example] Hereafter, this invention is explained with reference to a drawing. In addition, the same reference number is given to the same component, and explanation is omitted. Drawing 1 (a) is the drawing of longitudinal section of the 1st example of this invention, and drawing 1 (b) is the plan.
[0023] A heater 4 is pinched by the lower hot platen 2 and the bottom plate 5, and the lower hot platen 2 is heated. A temperature sensor 6 is arranged in the center section of the lower hot platen 2, and it heats to constant temperature, for example, 110 degrees C, with a thermoregulator 7. Although temperature may be set up with a thermoregulator 7, you may set up with a temperature setting means (not shown) by which the exterior became independent.
[0024] In order to give the structural additional coverage of a conveyance means to lay a mask 3, as for the lower hot platen 2, enlarging is more desirable than a mask 3 10-20mm. In this example, it may be 15mm.
[0025] Therefore, only a part with a large area of the lower hot platen 2 can raise the homogeneity of the heating transient of the mask 3 although the heat capacity of the lower hot-platen periphery section became large, when it makes the heat capacity of a periphery equivalent to a center section by at least one slot 8 along with the periphery of the lower hot platen 2 and lays a mask 3 in the lower hot platen 2.
[0026] In the conventional thermal treatment equipment, although the maximum temperature gradient within the field of the mask 3 of a heating transient was 5.5 degrees C, in the lower hot platen 2 of this invention possessing the with a width-of-face depth [20mm depth of 5mm] slot 8, it was 3.2 degrees C.

[0027] Moreover, it set to the transient which is also completely the same as when cooling the heated mask 3, and cools a mask 3, and although the maximum temperature gradient within the field of a mask 3 was 8.3 degrees C in conventional equipment, it was 4.8 degrees C in the lower hot platen of this invention possessing a slot 8.
[0028] Drawing 2 is the drawing of longitudinal section of the 2nd example of this invention.
[0029] It is the example which the thickness of the periphery 15 of the lower hot platen 12 was gradually decreased instead of forming a slot in a hot platen, and made the heat capacity of a periphery small.
[0030] Drawing 3 is the drawing of longitudinal section of the 3rd example of this invention.
[0031] It is the example which the thickness of the periphery 16 of the lower hot platen 13 was decreased continuously, and made the heat capacity of a periphery small.
[0032] Thus, by making thickness of the periphery of a hot platen thin, heating of a substrate or the temperature gradient in the 3rd page of the mask in the transient and stable state of cooling can be made small, and a resist pattern with a high precision can be formed.
[0033] Drawing 4 (a) is the drawing of longitudinal section of the 4th example of this invention, and drawing 4 (b) is the plan.
[0034] Like a semiconductor mask, in the case of a thick substrate, in a stable state, heat may be radiated from the substrate side, and the temperature of the substrate periphery section may fall from the temperature of a center section. In order to prevent this temperature fall, it is higher than the thickness of a mask 3, or the homogeneity at the time of elevated-temperature stability improves especially by arranging the side plate 14 of equal height.
[0035] When a side plate 14 is a thermally conductive high metal, heat is supplied to a substrate periphery, the temperature homogeneity of a transient worsens, but since thermolysis from a substrate periphery can be lessened while the quantity of heat supplied to a substrate periphery can be lessened in the case of thermally conductive low resin, temperature homogeneity at a transient and the time of stability can be improved. Since the lower hot platen 2 becomes an elevated temperature, a side plate 14 has small heat capacity, and it is desirable to use heat-resistant high polyimide resin or fluororesin.
[0036] Moreover, as well as the 1st example when using a metal for a side plate 14, and only the part of the heat capacity which increased with the side plate 14 enlarges a slot 8, temperature homogeneity of a transient can be realized.
[0037] Drawing 5 (a) is the profile of the 5th example of this invention, and drawing 5 (b) is the plan.
[0038] In order that the 1st - the 4th example might amend the thermal imbalance by a lower hot platen becoming larger than a substrate, they made small the heat capacity per unit area of the substrate periphery section, and were making substrate temperature take down to homogeneity a rise or the bottom.

[0039] On the other hand, the example of **** 5 makes a lower hot platen the almost same magnitude as a substrate, arranges a lower hot platen and the flank hot platen isolated thermally, and makes homogeneity take down substrate temperature to the surroundings of it a rise or the bottom.
[0040] As shown in drawing 5 (a), this thermal treatment equipment isolates the side of the lower hot platen 30 thermally with the gap object 34 with large thermal resistance, and arranges a flank hot platen. The side of a mask 3 is heated with a heater 32 and the flank hot platen 31 pinched by the bottom plate 33. By arranging the gap object 34, additional coverage can be given also structural.
[0041] The lower hot platens 30 are a temperature sensor 6, a thermoregulator 36, and the temperature setting means 35, for example, are heated at 110 degrees C. The flank hot platens 31 are a temperature sensor 37, a thermoregulator 38, and the temperature setting means 39, for example, are heated at 112 degrees C.
[0042] It prevents that heat radiates heat from the side of a mask 3 with the flank hot platen 31, and the temperature homogeneity of a mask 3 is raised.
[0043] It is suitable to set up the temperature of the flank hot platen 31 more highly 2-5 degrees C than the temperature of the lower hot platen 30.
[0044] As for the gap object 34, it is desirable for thermal resistance to use heat-resistant high polyimide resin and fluororesin greatly.
[0045] In that case, when a mask 3 is laid in the lower hot platen 30, since the heat transfer from the flank hot platen 31 to the lower hot platen 30 decreases, a mask 3 can be crossed to the whole surface and can carry out a temperature rise to homogeneity.
[0046] Although ****** [the number of the heaters 32 of the flank hot platen 31 / sides / of lower hot platens / four / one], by arranging a heater and a thermoregulator about each side, respectively, they can set the flank hot platen of each side as optimum temperature, and can raise soak nature further.
[0047] Drawing 6 is the drawing of longitudinal section of the 6th example of this invention.
[0048] This example adds an up hot platen to the 1st - the 5th example, and raises especially the temperature homogeneity of a stable state.
[0049] As shown in drawing 6 , this thermal treatment equipment is heated from all with the up hot platen 41 which pinched the mask 3 by the lower hot platen 30, the flank hot platen 31, and a heater 42 and a bottom plate 43.
[0050] The up hot platen 41 is set up with a temperature sensor 40, a thermoregulator 46, and the temperature setting means 45, and is controlled to constant temperature.
[0051] Moreover, by making the inferior surface of tongue of an up hot platen into the shape of a dome which has a concave surface as shown in the reference number 44 of drawing 6 , four corners of a mask 3 can be heated strongly and the temperature homogeneity at the time of a stable state can be raised.
[0052] In the example of **** 6, 2.5 degrees C and the maximum temperature gradient within a field at the time of elevated-temperature stability of the maximum temperature gradient within a field of the mask 3 of the heating transient when setting [the temperature of the lower hot platen 30] the temperature of 113 degrees C and the up hot platen 41 as 112 degrees C for the temperature of 110 degrees C and the flank hot platen 31 were 0.2 degrees C.
[0053] In the conventional thermal treatment equipment, since the heating transient was [the time of 5.5 degrees C and elevated-temperature stability] 0.5 degrees C, the engine performance improved sharply.
[0054] Although the above-mentioned explanation described the case where a thermal treatment equipment heated a substrate, if the heater of heating apparatus is made into an isothermal cooling water jacket or the condensator using the Bell Choi element, this invention is completely applicable about the case where a substrate is cooled, similarly.
[0055] Moreover, although explained taking the case of the mask for semiconductors, this invention is completely applicable to a semiconductor wafer, a liquid crystal panel, etc. which must heat-treat a substrate to high degree of accuracy in the above-mentioned explanation, similarly.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

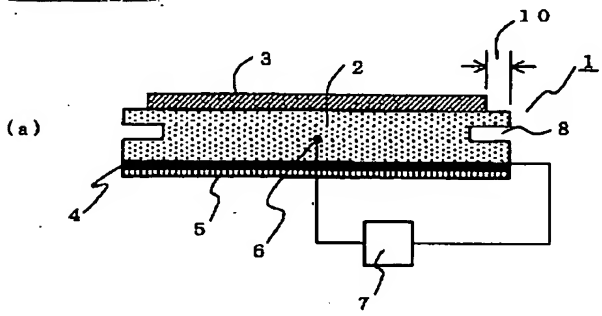
DESCRIPTION OF DRAWINGS

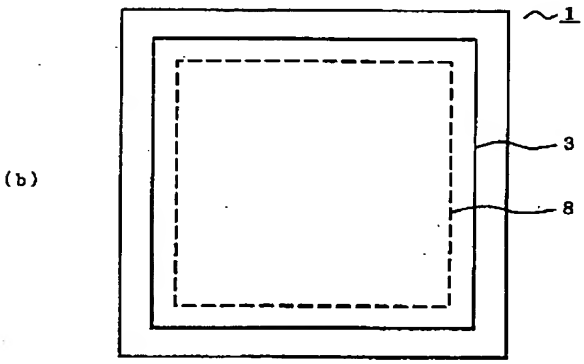
[Brief Description of the Drawings]
[Drawing 1] The 1st drawing of longitudinal section and plan of an example of this invention.
[Drawing 2] The drawing of longitudinal section of the 2nd example of this invention.
[Drawing 3] The drawing of longitudinal section of the 3rd example of this invention.
[Drawing 4] The 4th drawing of longitudinal section and plan of an example of this invention.
[Drawing 5] The 5th drawing of longitudinal section and plan of an example of this invention.
[Drawing 6] The drawing of longitudinal section of the 6th example of this invention.
[Drawing 7] The temperature profile of the conventional thermal treatment equipment.
[Description of Notations]
2, 12, 13, 30 -- A lower hot platen, 3 -- A mask, 4, 32, 42 -- Heater, 5, 33, 43 -- A bottom plate, 6, 37, 40 -- A temperature sensor, 7, 36, 38, 46 -- Thermoregulator, 8 [-- A periphery, 20 / -- It is the graph of the mean temperature of nine points, and 24 on a mask. / -- It is the graph of the maximum temperature gradient of nine points, and 31 on a mask. / -- A flank hot platen, 34 / -- A gap object,, 35, 39, 45 / -- A temperature setting means, 41 / -- An up hot platen, 44 / -- Concave surface.] -- A slot, 10 -- The amount of flashes, 14 -- 15 A

[Translation done.]

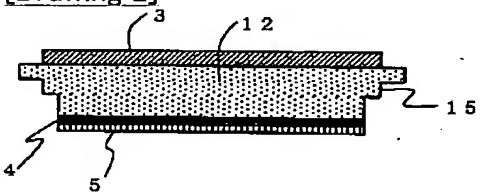
DRAWINGS

[Drawing 1]

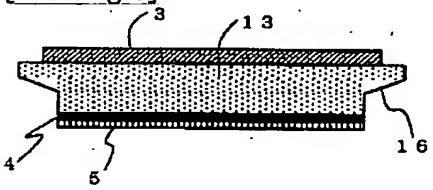




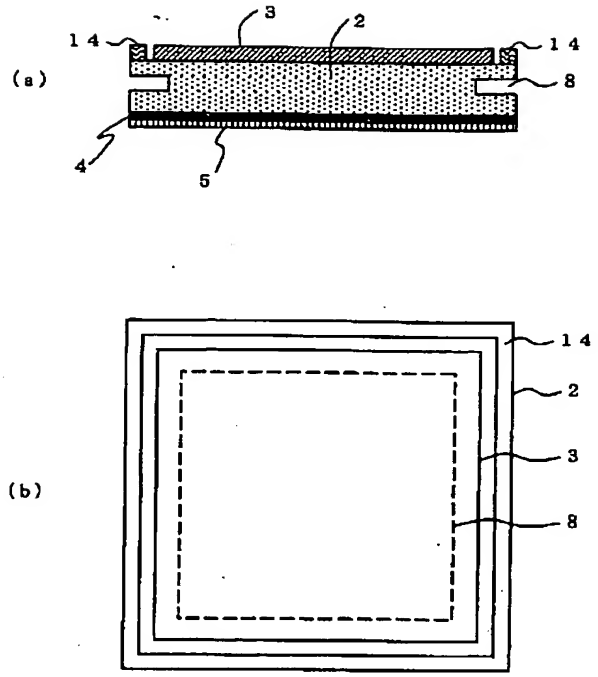
[Drawing 2]



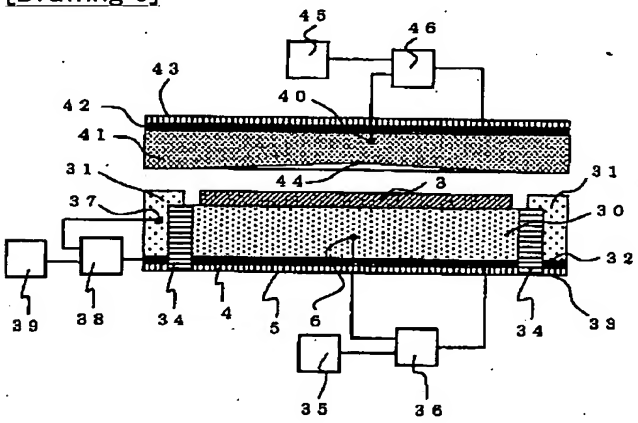
[Drawing 3]



[Drawing 4]

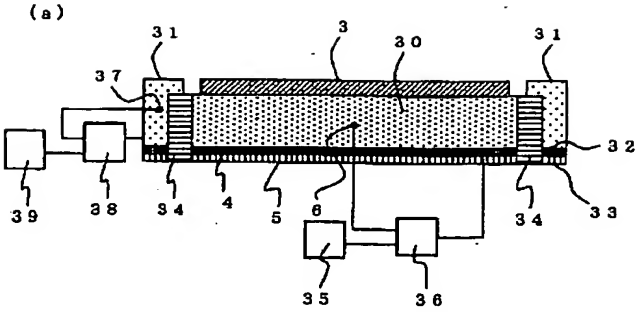


[Drawing 6]

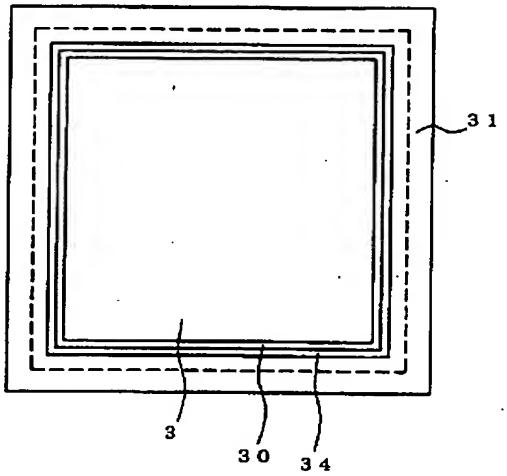


[Drawing 5]

(a)

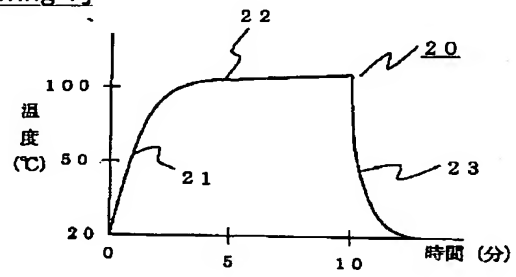


(b)

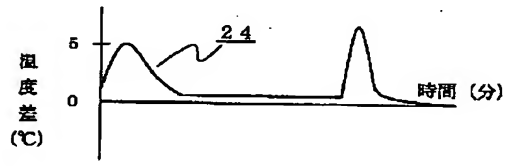


[Drawing 7]

(a)



(b)



[Translation done.]